14. The MOEMS of Claim 11, wherein the structure of the grating is selected based on the requirement of the time delay.

15. The MOEMS of Claim 14, wherein the structure of the grating includes a physical dimension in mm and a critical dimension in line/mm.

16. The MOEMS of Claim 11, wherein the wavelength λ of the incident wave is known, and the angle of incident is selected to force the beam to have a maximum diffracted power in "-1 order" and strikes perpendicular on the focusing lens and scanner mirror.
17. The MOEMS of Claim 11, wherein the lens has a focal length of F and is placed at a distance F from the grating.

18. The MOEMS of Claim 11, wherein the lens is a simple achromatic lens.

19. The MOEMS of Claim 11, wherein the lens is a quasi optics focusing and collimating system based on an electro magnetic domain of operation.

20. The MOEMS of Claim 11, wherein the optical components and associated controls comprise a micro-opto-electro-mechanical system (MOEMS) optical scanner.

21. The MOEMS of Claim 11, wherein the scanner is based on a thermal actuator to produce an IC-based integrated scanner mirror (ISM).

Abstract

Electromagnetic waves in wide frequency ranges up to photonics have been used for applications to time-domain imaging (TDI). Realistic time domain imaging requires a rapid optical delay line on the order of 100 ps with sampling rate at least 100 Hz. Present available optical time delay systems suffer either from low sampling rate or low time delay length, deviating from ideal requirements. The purpose of this invention is to introduce a miniature and rapid scanning optical delay line based on micro-opto-electro-mechanical systems (MOEMS) technology to improve the data acquisition in time domain imaging, capable of sampling rate beyond 100 Hz and time delays beyond the 100 ps.